PATENT ABSTRACTS OF JAPAN

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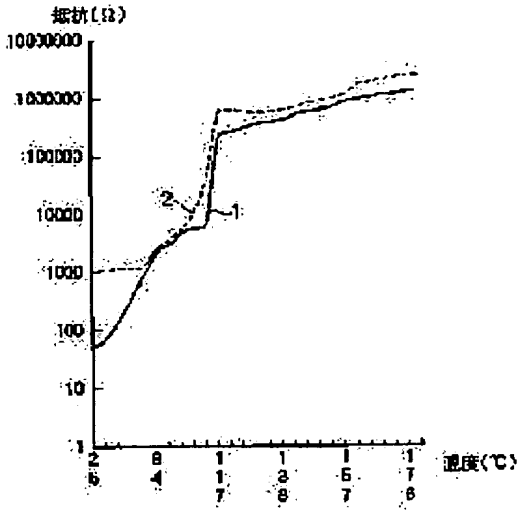
(54) OVERCURRENT PROTECTIVE ELEMENT

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a highly reliable overcurrent protective element which maintains a low-resistance characteristic at normal temperature and a high- resistance characteristic at high temperatures and moreover has a low resistance at the normal temperature.
SOLUTION: An overcurrent protective element is provided with many particles, each composed of internal particles formed by granulating and molding a second conductive material having a high resistance and a coating section coating the surface of the internal particle and made of a first conductive material. The element is manufactured by compression molding of the coated particles into a flat body having a thickness of 0.01-100 μm. At a normal temperature, the element shows a low-resistance characteristic 1 of the conductive polymer constituting the coating sections, but at a high temperature, a high resistance characteristic 2 of a high-resistance material constituting the internal particles becomes apparent.



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CLAIMS

[Claim(s)]
[Claim 1] In the component for overcurrent protection for protecting an electrical circuit as a PTC component which is connected to the equipment which supplies power at a serial, and has an impedance RL ohm this component for overcurrent protection Consist of the first electrical conducting material corned and fabricated including a conductive polymer, and the second electrical conducting material containing high electrical resistance materials, and the coat of said first electrical conducting material is carried out to this second electrical conducting material. It has many coated particles which consist of the coat section which carries out the coat of the outer surface to an internal particle. It is compressed and fabricated so that it may have the thickness of 0.01-100 microns and these coat sections may contact closely. The component for overcurrent protection characterized by the high electrical resistance materials in said second electrical conducting material showing a high resistance maintenance property at the time of an elevated temperature while the conductive polymer in said first electrical conducting material shows a low resistive characteristic in ordinary temperature.
[Claim 2] It is the component for overcurrent protection which mixes said first electrical conducting material at a rate that a graphite and the polyethylene as a conductive polymer were able to be defined beforehand, in the component for overcurrent protection according to claim 1, and is characterized by the high electrical resistance materials in said second electrical conducting material being barium titanate.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the component for overcurrent protection circuit q constituted with the PTC component ingredient with the PTC effectiveness.
[0002]
[Description of the Prior Art] It is known conventionally that specific resistance will change [a conductive ingredient] according to temperature. What shows a forward temperature coefficient among the electrical conducting materials with which a specific resistance value increases rapidly in a certain temperature requirement is called the PTC component ingredient.
[0003] Generally a PTC component ingredient is divided into two kinds. The ceramic PTC component ingredient with which one is represented by inorganic oxide like barium titanate, and another have a conductive polymer ingredient, for example, the PTC component ingredient using the conductive polymer which is made to distribute a special conductive ingredient (filler) and is formed into a polymer.
[0004] As a description about a ceramic PTC component ingredient, it has the electrical property stabilized as an advantage, and excels in the repeatability in the activity of a repeat.
[0005] By the way, the specific resistance values in ordinary temperature (25 degrees C) were more than 10 ohm and cm also in research in recent years, and the application to the circuit in a high current was what is limited. Moreover, although it was a ceramic also in the mechanical property therefore, it was weak, and there was a fault that shaping was difficult.
[0006] On the other hand, about the PTC component ingredient using a conductive polymer, as an advantage, in ordinary temperature (25 degrees C), a low specific resistance value (below 10 ohm and cm) is shown, it sets to an elevated temperature (near 120 degree C), and the high specific resistance value of 1000 times or more of the specific resistance at the time of ordinary temperature is shown. Therefore, wide range application was attained to the circuit in a high current, and the miniaturization also became possible again.
[0007] However, since the fundamental principle of the PTC effectiveness originates in fusion of a crystalline polymer, anxiety is in the dependability over the activity of a repeat. Moreover, also about a mechanical property, for a thermoplastic polymer, deformation tended to take place at the time of an elevated temperature, and there was a fault of being easy to start an open circuit and a short circuit.
[0008] A means to distribute inorganic oxides, such as barium titanate, as an electrical conducting material distributed in the configuration of the component for overcurrent protection circuits using a PTC component at a conductive polymer so that a property and dependability may be improved with the presentations of a ceramic ingredient or a conductive polymer is used to the fault of such a Prior art.
[0009]
[Problem(s) to be Solved by the Invention] However, not the thing that compensates the fault which a ceramic ingredient and a conductive polymer have fundamentally also with the PTC component which distributed such an inorganic oxide but a PTC component with the desired resistance-temperature characteristic was not able to be obtained.
[0010] Then, the technical technical problem (object) of this invention is obtaining, a PTC component, i.e., an overcurrent protection component, with the desired resistance-temperature characteristic.
[0011] That is, in ordinary temperature, while the low resistive characteristic which is the description of a conductive polymer is shown, in the time of an elevated temperature, it is characterized by showing the property

of holding high resistance in high electrical resistance materials, for example, a ceramic ingredient, and and it excelled in dependability, the overcurrent protection component which shows the small property of the resistance in ordinary temperature is offered.
[0012]
[Means for Solving the Problem] In the component for overcurrent protection for protecting an electrical circuit as a PTC component which is connected to the equipment which supplies power at a serial, and has an impedance RL ohm according to this invention The first electrical conducting material with which this component for overcurrent protection is corned and fabricated including a conductive polymer, Consist of the second electrical conducting material containing high electrical resistance materials, and the coat of said first electrical conducting material is carried out to this second electrical conducting material. It has many coated particles which consist of the coat section which carries out the coat of the outer surface to an internal particle. It is compressed and fabricated so that it may have the thickness of 0.01-100 microns and these coat sections may contact closely. While the inside of said first electrical conducting material shows the low resistive characteristic of a conductive polymer in ordinary temperature, the component for overcurrent protection characterized by the high electrical resistance materials in said second electrical conducting material showing a high resistance maintenance property at the time of an elevated temperature is obtained.
[0013] In this component for overcurrent protection, said first electrical conducting material is mixed at a rate that a graphite and the polyethylene as a conductive polymer were able to be defined beforehand, and the component for overcurrent protection characterized by the high electrical resistance materials in said second electrical conducting material being barium titanate is obtained.
[0014]
[Embodiment of the Invention] Hereafter, the component for overcurrent protection by the gestalt of operation of this invention is explained using drawing 1 - drawing 3 .
[0015] As shown in drawing 2 , with the overcurrent protection component by the gestalt of operation of this invention, it consists of the first electrical conducting material corned and fabricated including a conductive polymer, and the second electrical conducting material containing high electrical resistance materials. By carrying out the coat of the second electric conduction material with the first electrical conducting material, it has many coated particles which consist of the coat section 4 which consists of the first electrical conducting material which carries out the coat of the outer surface to the internal particle 3 which consists of the second electrical conducting material, and it is compressed and fabricated so that it may have the thickness of 0.01-100 microns and these coat section 4 comrades may contact closely.
[0016] As for the first electrical conducting material, insulating materials, such as polyethylene, an acrylic, and a polyvinyl chloride, are used as a conductive polymer. The first electrical conducting material consists of ingredients, such as an inorganic oxide, a metal, a graphite, and carbon black, in addition to a conductive polymer.
[0017] Moreover, the high electrical resistance materials in the second electrical conducting material have the metal of inorganic oxides, such as semiconductor materials, such as barium titanate, and SiCSnO, kanthal, and nickel chromium etc. Here, kanthal is used for the electrical resistance materials for electric heat like Nichrome with the Fe-Cr-aluminum-Co alloy of a Kanthal line.
[0018] In the case of compression and shaping, if metallizing of the electrode is carried out to both sides, respectively after two or more coated particles become flat [-like] in response to a pressure, for example, are formed in disc-like, they can manufacture the PTC component which is a component for overcurrent protection of this invention. In the electrical circuit which connected the component for overcurrent protection of this invention, a current flows for the overcurrent protection component of this invention through a circuit protector from a power source, and an overcurrent protection component, i.e., a PTC component, is heated. And a current comes to flow via the second electric conduction material as resistance of the first electrical conducting material of a PTC component goes up and the resistance of the second electrical conducting material is exceeded by unusual lifting of the current of a circuit, or temperature. In order that the second electrical conducting material may show 99% of high resistance of at least 3000 ohm and cm by the temperature rise of a PTC component, high resistance is held with a part of first electrical conducting material and the second electrical conducting material at this event, and the function for overcurrent protection controls abnormal current below on a normal current.

[0019] In this invention, transposing the vinyl system resin of German **, such as acrylic resin, such as olefin system resin, such as polyethylene and polypropylene, and the poly metal acid methyl, a polyvinyl chloride, and polyvinyl acetate, styrene-acrylonitrile resin, a polyamide, a polycarbonate, fluoride system resin, fibrin system resin, formalin system resin, an epoxy resin, unsaturated polyester, alkyd resin, polyamide resin, polyurethane, diallyl phthalate resin, and resin to rubber as resin of an insulating material, or mixing, and constituting the conductive polymer in the first electrical conducting material is mentioned.
[0020] An inorganic oxide, a metal, a graphite, carbon black, etc. are mentioned as an ingredient with which the first electrical conducting material is mixed with a conductive polymer.
[0021] As high electrical resistance materials of the second electrical conducting material, metals of high resistance, such as inorganic oxides, such as the semiconductor materials SiO2, such as barium titanate, and SnO, kanthal, and nickel chromium, are mentioned.
[0022] According to this invention, a PTC component will be heated if a current flows for an overcurrent protection component through a circuit protector from a power source. And a current comes to flow via the second electrical conducting material as resistance of the first electrical conducting material which constitutes a PTC component goes up and resistance of the second electrical conducting material is exceeded by unusual lifting of the current of a circuit, or temperature. In order that the second electrical conducting material may show 99% of high resistance to at least 3000 ohm and cm by the temperature rise of a PTC component, high resistance is held with a part of first electrical conducting material and the second electrical conducting material at this event, and overcurrent protection controls abnormal current below on a normal current.
[0023]
[Example]
[A table 1]

	ポリエチレン (Vol%)	黒鉛(Vol%)	常温抵抗率(Ω-cm)
試料a	71	29	10. 0
試料b	65	35	8. 5
試料c	63	37	7. 2
試料d	58	42	5. 6
試料e	51	49	2. 0

[0024] The first electrical conducting material of a table 1 is the mixture of a conductive polymer and an insulating material. As the first electrical conducting material, it mixes in the rate which shows the graphite as the high density polyethylene and the insulating material of a conductive polymer in a table 1, and in the temperature of 185 degrees C, it kneads for about 10 minutes using a mixing roller, and fully distributes. Sample a-e, i.e., the first electrical conducting material kneading object, was obtained. The resistivity of the first electrical conducting material kneading object chose the compounding ratio of polyethylene and a graphite so that it might be set to 5000 ohm and cm in 2 ohm and cm, and 120 degrees C in ordinary temperature.
[0025]
[A table 2]

	ポリエチレン(vol%)	チタン酸バリウム(vol%)	常温抵抗率 (Ω-cm)
試料A	71	29	100. 0
試料B	65	35	70. 0
試料C	63	37	40. 0
試料D	58	42	33. 0
試料E	51	49	25. 0

[0026] The second electrical conducting material of a table 2 is the mixture of barium titanate and the high

density polyethylene of a conductive polymer.
[0027] In the second electrical conducting material, barium titanate powder with a diameter of 1 micron was corned so that it might become a sphere with a diameter of about 50-60 microns. Sample A-E, i.e., the second electrical conducting material granulation object, chose the thing of the presentation which serves as 4500 ohm and cm in 100 ohm and cm, and 120 degrees C in ordinary temperature.
[0028] In the temperature of about 200 degrees C, the first electrical conducting material kneading object was dissolved after sintering the second electrical conducting material granulation object, and in it, the barium titanate which is the second electrical conducting material granulation object was mixed, and it kneaded in the mixing roller. The first electrical conducting material which covers the second electrical conducting material was adjusted so that it might become about 50 microns in thickness.
[0029] The coat particle which covered the first electrical conducting material to the second electrical conducting material performed the heat press in about 180 degrees C, and it adjusted it so that it might become 300 microns in thickness. The configuration acquired by this was a sheet-like. Two sheets were stuck on this sheet with a heat press in the nickel plate thickness direction. The temperature of the overcurrent protection component obtained by this and the relation of resistance are shown in drawing 1 . Since the resistivity of the second electrical conducting material is high, in ordinary temperature (26 degrees C), a current flows the first electrical conducting material to the resistivity of the first electrical conducting material, so that clearly from drawing 1 . On the other hand, in the temperature of 120 degrees C, the first electrical conducting material shows the forward temperature characteristic, and exceeds the resistivity of the second electrical conducting material. The current which flows in this condition flows the second electrical conducting material with small resistivity through a part of first electrical conducting material. Next, Sample a and Sample d are fractured and the result of having carried out mirror plane processing using diamond paste, and having observed the cross section in the electronic-raster-scanning microscope is shown in drawing 2 .
[0030]
[Effect of the Invention] As explained above, since the overcurrent protection component by this invention consists of many coat particles, at the time of ordinary temperature, a current flows to the conductive polymer of the coat section of a coat particle, and it shows the low resistivity (below 10-ohm and cm) property of this conductive polymer.
[0031] As a result of a current's flowing into the granulation and the fabricated particle inside a coat particle on the other hand in the condition that generation of heat by the elevated-temperature condition and the overcurrent has occurred, the high resistive characteristic of a particle ingredient becomes remarkable.
[0032] Therefore, according to this invention, it is effective in it being stable in property and the overcurrent protection component excellent in repeatability and dependability being obtained.

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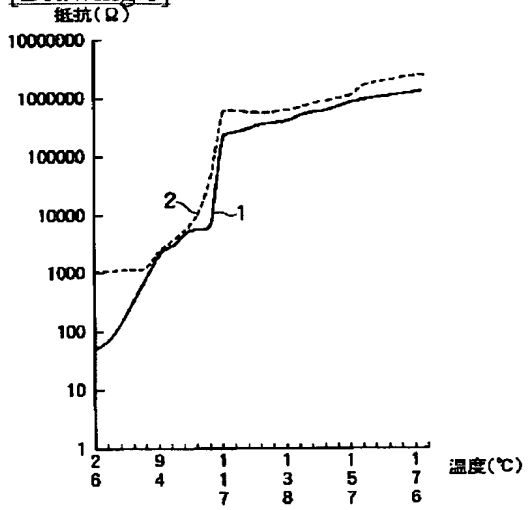
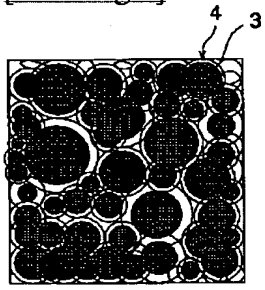
DRAWINGS

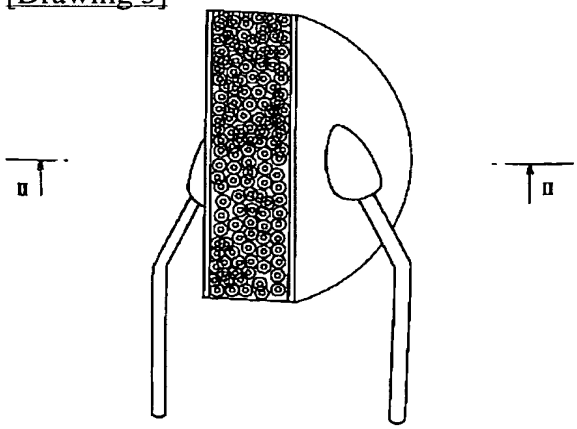
[Drawing 1]



[Drawing 2]



[Drawing 3]



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